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Application No. 2002/0254

Date of Filing 5 April 2002

Applicant PRINCIPAL SOFTWARE DEVELOPMENTS LIMITED, an Irish company of Commercial House, Westend Village, Blanchardstown, Dublin 15, Ireland.

Dated this 9 day of March 2004.



An officer authorised by the
Controller of Patents, Designs and Trademarks.

REQUEST FOR THE GRANT OF A PATENT

PATENTS ACT, 1992

The Applicant(s) named herein hereby request(s)

X the grant of a patent under Part II of the Act

_____ the grant of a short-term patent under Part III of the Act
on the basis of the information furnished hereunder.

1. Applicant(s)

Name Principal Software Developments Limited

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Description/Nationality

An Irish company

2. Title of Invention

"A warehouse management system"

3. Declaration of Priority on basis of previously filed application(s) for same invention (Sections 25 & 26)

Previous filing date

Country in or for
which filed

Filing No.

4. Identification of Inventor(s)
Name(s) of person(s) believed
by Applicants(s) to be the inventor(s)

FLANAGAN, PETER
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5. Statement of right to be granted a patent (Section 17(2) (b))

The Applicant derives the rights to the Invention by virtue of a Deed of Assignment dated March 26, 2002

6. Items accompanying this Request – tick as appropriate

- (i) ☒ prescribed filing fee (EUR125.00)
- (ii) ☒ specification containing a description and claims
☐ specification containing a description only
☐ Drawings referred to in description or claims
- (iii) ☐ An abstract
- (iv) ☐ Copy of previous application(s) whose priority is claimed
- (v) ☐ Translation of previous application whose priority is claimed
- (vi) ☒ Authorisation of Agent (this may be given at 8 below if this Request is signed by the Applicant (s))

7. Divisional Application (s)

The following information is applicable to the present application which is made under Section 24 –

Earlier Application No:

Filing Date:

8. Agent

The following is authorised to act as agent in all proceedings connected with the obtaining of a patent to which this request relates and in relation to any patent granted -

Name

John A. O'Brien & Associates

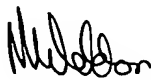
Address

The address recorded for the time being in the Register of Patent Agents, and currently Third Floor, Duncairn House, 14 Carysfort Avenue, Blackrock, Co. Dublin, Ireland.

9. Address for Service (if different from that at 8)

As above

Signed



JOHN A. O'BRIEN & ASSOCIATES

Date April 5, 2002

"A warehouse management system"Introduction

- 5 The invention relates to a warehouse management system.

A major difficulty with any warehouse system is the ability to track the individual items throughout their stay within the warehouse. In particular, the ability for warehouse management systems to cope with a variety of different tracking requirements, storage requirements and in the case of contract warehousing, customer requirements.

The following are some of the major requirements which must be met.

- 15 1. What happens when the stock does not exist within a location, but is on the loading bay or has been broken down from the pallet and is loose in the aisles?
2. What happens when we are not storing pallets, we are managing drums of chemicals or other odd configurations of product?
- 20 3. What if we have a number of different tracking references on an item, i.e. different batch numbers, different products etc. contained within the item. A typical scenario would be the storing of intervention beef where a pallet could contain different cuts of meat and different lot numbers?
4. What happens when we take a number of items from a pallet and transfer them to a new pallet or take them away for sampling?
- 25 5. What happens when we take items and merge them with an existing pallet but with totally different tracking id's (i.e. batch numbers)?
6. How could I find out what my effective stock position was as at any particular point in time, moreover how can I find out what my stock position was 6 weeks ago for batch number 1234 production date 01/01/01?

7. What if I needed to track a batch number issued from the warehouse 4 years ago?
8. How do I manage the different track and trace requirements for a number of different customers, i.e. I am a contract warehouse and I have one customer storing chemicals and another storing meat? One is interested in batch numbers; the other is concerned with lot numbers and best before dates etc.
9. How do I cater for the many various forms of goods that may be stored within the warehouse, and how can I provide my customers with accurate stock information down to the very lowest level i.e. the case or even a bottle?
10. How do I ensure that every single item that comes into the warehouse is traceable to its eventual point of exit? i.e. a warehouse is a closed system, therefore what goes in must come out?
11. If I am managing stock for many different customers, how can I guarantee that there will be no confusion of different customer's stock even if they have the same product code number system and I am forced to record stock by their number systems?

The invention is directed towards providing a warehouse management system to meet some or all of these requirements.

Statements of Invention

According to the invention, there is provided a warehouse management system comprising an input interface, an output interface, a database controller and associated storage device, and a processor, wherein the processor comprises means for

defining each item in an item record having a unique reference and a quantity within a warehouse closed system.

In one embodiment, the processor comprises means for setting item quantity to zero upon exit of an item from the warehouse closed system.

- 5 In another embodiment, an item is defined as a group of units stored together, and the processor comprises means for generating new item records if the units are divided.

10 In a further embodiment, the processor comprises means for defining each item independently of location, in which present location is a current attribute.

In one embodiment, the processor comprises means for generating the unique reference from a plurality of sources of alphanumeric characters.

- 15 In another embodiment, the sources include a warehouse identifier, and a transaction which caused the item to exist.

In a further embodiment, the sources include an identifier of each different category of product within the item.

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In one embodiment, the processor comprises means for generating a transaction record linked to an item record for each transaction affecting an item.

Detailed Description of the Invention

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The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only.

30 A warehouse management system of the invention has a database in which item records are keyed according to a unique reference (UR). Each item record relates to

a unique "item", defined as the highest level of a unit of stock that is to be managed. Division of an item, such as transfer of some cases from an original pallet to another results in creation of a new item, leaving the original item (for the pallet) extant.

- 5 The items are defined independently of their locations, the locations being only fields of data within the item records.

Also, the system defines transactions in transaction records linked to the item records linked to the item records. Two such transactions are entry to and exit from the
10 warehouse, treating the warehouse as a closed system causing a zero quantity balance after an exit transaction.

The transaction records provide a comprehensive audit trail for warehouse items.

- 15 The following describes the structure and operation of the management system in more detail.

Unique Reference (U.R.)

20 **Objective**

The objective of the unique reference is to ensure that:

1. Every single item that enters the warehouse is uniquely identified.
- 25 2. To ensure that the item exists within its own right no matter where or how it is stored within the warehouse
3. The item is unique for eternity or for as long as the historical data within the database is retained.

4. To enable the activities carried out on item and the sub-components of the item to be tracked during its stay within the warehouse.
5. To ensure that the warehouse is a closed system. i.e. that when an item is given this unique reference, that the subsequent activities performed on that item or U.R will result in a zero balance once that item has left the warehouse or been transformed into another item within the warehouse.
6. To provide a visible audit trail on the item.
7. In the case where there are multiple warehouses registered with a unique warehouse code, then the unique reference will also be unique throughout all registered warehouses.

The unique reference consists of 7 parts. The parts are alpha-numeric meaning they can be either numbers or characters. Each part is separated by a "separator character", this could be a ':', a ',' or any other character that will NOT be used within each part. This means that there is no limit on the size or content of each part, however once the part size and content is initially established, it CANNOT be altered otherwise there would be a danger of duplicate unique identifiers. Each part is broken down as follows:

- Part 1 – The warehouse identifier. This is a code that will identify the warehouse that the item originated from. It must be unique among multi-warehouse systems. It may also be a unique international warehouse code if this ever eventuated.
- Part 2 – The transaction type. Again this is linked to the transaction concept, it is the type of transaction that originated the item (i.e. a goods in transaction or receipt into the warehouse). Refer to the transaction concept for more detail.
- Part 3 – The transaction number. Each transaction type will have its own unique number system. This could therefore be the goods-in number if the transaction type is a goods-in transaction.

Part 4 – The line number on the transaction. Transactions are broken down into lines. This is simply to indicate a group of like items together (i.e. 10 pallets of the same product code and batch number or something similar).

5 Part 5 – The item number within the Line number. Within each line each item receives a unique item number. In the case above each pallet would receive a unique item number. It will depend on the “Unit Set” that is being used at the time. i.e. if we are storing individual drums, then each drum would receive a unique reference.

10 Part 6 – The item group number. Within each item there may be a number of groups that require discreet tracking, for example you may have three different batch numbers on the one pallet. This is used in pallet merging situations where the tracking of certain “Principal Identifying” data is essential.

15 Part 7 – A work reference (optional). It can be used internally for temporary transformation of an item or special requirements depending on the transaction type concerned.

Parts may be omitted and replaced with fill characters such as zeros provided that the uniqueness of the references is not effected and that it identifies the traceable item.

20 This reference will remain with the item throughout its life within the warehouse. Once the item has been confirmed into the warehouse an initial transaction record is generated that represents the initiating process. i.e. a goods in transaction is recorded with all the information including the unique reference quantities etc. Whenever an action is subsequently performed on that item, it must be performed through a predefined transaction. i.e. a stock adjustment would require a stock adjustment
25 transaction; a stock transfer would require a stock transfer transaction. Each of these transactions will record a transaction record with this unique reference on it. The transactions history file can only be added to and never deleted from (apart from specific archiving routines) or changed. A number of different examples of unique references would be:

Warehouse	Trx Type	Trx No.	Line No.	Item No.	Item Group No.	Sep Chr	Unique Reference
"W1"	"R "	"0001234"	"01"	"0003"	"0000"	":"	W1:R :0001234:0003:0000
"AX123468"	"154"	"00898789"	"0192"	"19283"	"12390"	","	AX123468,154,0089 8789,0192,19283,12 390
"W1"	"R "	"0001234"	"01"	"0003"	"0000"	":"	W1:R :0001234:0003:0000: X91829 (Has the 7'th part used for work purposes)

5 In the first example there is a small warehouse code and each of the component parts are designed to suit the application. The resultant unique reference is smaller than example 2 and would be attractive for bar code scanning etc. The important point is that the Part sizes, once established are the same and the separator character is consistent. Also the transaction type, number, line number, item number and item group number must be unique within their parent. i.e. even if you are not using the transaction concept as described within the document, it is imperative that the component parts are hierarchically unique within each other. Otherwise the unique reference will not be unique!

15 An example of the tracking once the item is identified would be a single pallet with 100 cases on it:

Seq	U.R.	Trx Type	Qty of	Running Qty	New resulting unique reference
1	W1:R	"R " - Goods In	+100	100	

	0001234:0003:0000				
2	W1:R 0001234:0003:0000	"D " - Delivery	-5	95	
3	W1:R 0001234:0003:0000	"A " - Adjustment of 1	+1	96	
4	W1:R 0001234:0003:0000	"T " - Internal transfer entire item from one location to another	0	96	
5	W1:R 0001234:0003:0000	"H " - Item held	0	96	
6	W1:R 0001234:0003:0000	"R " - Item Released	0	96	
7	W1:R 0001234:0003:0000	"T " - 5 cases transfers to another pallet with reference W1:R 0005678:0022:0000 and a different batch no	-5	91	W1:R 0005678:0022: 0001, this will be the unique reference of the new 5 cases see notes below.
8	W1:R 0001234:0003:0000	"T " - 5 cases transfers to another pallet with reference W1:R 0005678:0023:0000 and the same batch no	-5	86	W1:R 0005678:0023: 0000, this will be the unique reference of the new 5 cases, which are merged with the "to" pallet see notes below.
9	W1:R 0001234:0003:0000	"D " - Delivery of final qty	-86	0	

In this example each sequence is an individual transaction record. If we associate dates with these records, then we would be able to get an As At position of stock at

any interval. I.e if we wanted a position of stock at the date associated with the transaction at sequence number 4 we would get a figure of 96. Also notice that some transactions have no effect on the overall balance as they are internal or they may only affect non-quantity related data (see the transactions concept for explanation on how transactions are created to ensure tracking).

On sequence number 7, 5 cases were transferred to another pallet. Depending on the grouping rules for the principal identifier (see concept 7), the 5 cases must remain unique on the new pallet, therefore it cannot retain its old reference because the 91 cases left on the pallet will use that reference, it cannot use the reference of the "TO" pallet, because it must retain batch number trace ability and therefore must remain as a discreet item. It is therefore given the "TO" pallet unique reference and the item group number is incremented by one to ensure it is unique. The "FROM" unique reference is recorded with the transaction so that its origin can be traced.

In example 8 the batch numbers and the grouping rules dictate that batch numbers are the only identifiers that must be traced. Therefore the item is not required to be kept as a discreet item and is merged with the "TO" item increasing its stock value by 5.

Finally the item is delivered from the store and the balance becomes zero.

Unit Sets

Objective

The purpose of the unit set is to allow for the flexibility to handle any type of stock and its subsequent variations of configuration.

It is literally a set of units of measure that together define the product in terms of:

1. Storage requirements
2. Breaking down requirements
3. Secondary measurement requirements

5

Each of the units of measure must relate to each other. A unit may be defined as one of 4 types:

1. – Integral
- 10 2. – Volume
3. – Weight
4. – Measurement

For example: A pallet is the Storage Unit and will be related to the warehouse configuration (see concept 4). The pallet consists of Cases and therefore cases may be removed from the pallet. When the last case is removed, the pallet is empty and is therefore gone. In addition to this, the cases may have weight recorded against them as a secondary unit. The configuration of this unit set is:

- 20 1. – Storage Unit = Pallet
2. – Primary Unit = Case
3. – Secondary Unit = Kilogramme

The important rule with the definition of a unit set is that the Storage and Primary units must be integral.

25

In another example, we may define a unit set with only drums and litres. The configuration will be:

- 30 1. – Storage Unit = Drums

2. – Primary Unit = DRUMS

3. – Secondary Unit = Litres

5 In this example the drum cannot be broken down into integral parts, therefore the storage and primary units are the same. There is no limit on the number of secondary units that may be recorded. In addition to litres we could also record weight.

10 The unit set is also designed to allow multiple packing definitions per product. For example: Product X may be packaged in both drums and kegs. In this scenario there would be two unit sets defined for this product, one for the drums and another for the kegs.

15 The storage and primary units are integral as they must allow for definite states of presence. i.e. they are either there or not there. If non integral units were used, (i.e. tonnes) then there could be some ambiguity as to whether all the tonnage was there or not there (i.e. residual decimals). The storage unit is used to link the items to the warehouse configuration and controls the locations empty or full status (capacity). The primary unit allows the storage unit to be broken down and therefore when the
20 last item is gone, so too is the storage unit. The secondary units may therefore store anything.

For example: this structure is particularly important for storage like cold storage. Take a pallet of cases of meat. If you store and freeze 1 tonnes of meat, it will loose
25 weight during the freezing process. So you may only end up delivering 0.9876 tonnes. As the unit set rules insists on the storage and primary units being integral, when the item is delivered the number of cases or pallets must be designated in integral quantities, even if the request was for 0.5657 tonnes, it would have to round up or down to the nearest whole primary unit (case). Once the entire Unique
30 Reference has been delivered, the storage and primary units will be zero, but the

secondary unit would have a variance of 0.0224 tonnes. A "Weight Difference" transaction could then be recorded to note the weight loss.

Transactions

5

Objective

10 The transactions are indented to record every action performed on a stock item during its stay within the warehouse, and as such form an audit trail. Many of the actions performed in the warehouse are in essence the same. (i.e. they add stock to the warehouse, remove stock from the warehouse, transform stock from one form to another etc.) They reason for performing these will differ and it is the purpose of the transactions to:

- 15
1. Control the behaviour of an action against a stock item
 2. Record the actual details of that action for audit/track and trace purposes.

In other words nothing can be done to a stock item, unless it is performed through a transaction.

20

The objective is therefore to provide a mechanism that is flexible enough to cater for any warehouse action conceivable to be performed, tracked and audited.

25 As these transactions represent an action within the warehouse, they will also control process flow.

The final objective is to be able to associate charging and costing details with certain actions performed within the warehouse.

Transactions are defined by a unique type code. The type code therefore identifies what action was performed. Any number of transaction types may be designated. For each transaction types a number of standard rules may be defined. For Example: the effect on stock. (i.e. into stock, out of stock, internal transaction, adjustment, no effect on stock etc.), Other linked transactions (parent and sub transactions) etc.

Every new transaction will receive a unique number for that transaction type. (i.e. the goods in transaction type may be specified as transaction type "GI". The GI numbering system will commence at 1 to whatever.). This will be used when generating the Unique Reference.

To each transaction type, a number of phase codes may be assigned. Each phase represents a process that occurs before the transaction is finally confirmed as being complete. These phases could be sequenced or could simply be used to indicate a particular condition or stage of the transaction. At each phase a number of rules or sub actions could be specified to be performed.

When a transaction is confirmed as being completed, a record of that transaction is made. Each record stored must be stored with at least the unique reference, date, time and quantities of the item that the transaction was performed against although it should also record responsibility information and other details as deemed necessary for auditing & tracking purposes. These transaction records cannot be deleted or changed.

A single transaction could affect many unique references. In order to structure these, the transaction will use unique lines within the transaction for groups of similar items and unique items within a line to represent each unique reference.

Some examples of a transaction that put stock into the warehouse:

Example 1:

The transaction type is a goods in with three products and 8 pallets of stock. The transaction type will be 'R ', the designate transaction number is 1234 and the
5 warehouse is 'W1'.

Product	Line Number	Item Number	No Pallets/Cases	U.R.
Bananas	1	1	3/300	"W1:R:0001234:01:0001:0000"
		2		"W1:R:0001234:01:0002:0000"
		3		"W1:R:0001234:01:0003:0000"
Apples	2	1	2/200	"W1:R:0001234:02:0001:0000"
		2		"W1:R:0001234:02:0002:0000"
Oranges	3	1	2/200	"W1:R:0001234:03:0001:0000"
		2		"W1:R:0001234:03:0002:0000"

For this transaction type we have designated a number of processes or phases that match the operation for this warehouse:

10

Phase 1 – Record Goods In details as supplied by driver ("RECORD").

Phase 2 – Unload the vehicle and check the details are correct ("CHECKING").

Phase 3 – Put the stock into the warehouse ("PUTAWAY")

Phase 4 – Add charging details ("CHARGE").

15 Phase 5 – waiting arrival.

This is a totally arbitrary assignment of phase code. In this example phases 1,2,3,4 may follow each other automatically. Phase five may be left aside for pre entering the transaction in anticipation of its arrival.

20

Once the last phase in the automatic sequence is executed, the transaction becomes confirmed and must not be altered from that point forward

5 Note also the way the Unique Reference is generated, as this is the first time these goods have arrived.

Example 2:

10 This time the stock is adjusted into the system because the goods in transaction had been confirmed, but one pallet had been left out. The transaction type to be used for this would be an adjustment transaction and we could assign the transaction type code as "A". The transactions number is 78.

15 This time, when we record the transaction, the additional information we would record against it would be the original goods in transaction number that the item should have been added to. This will ensure that when we track goods in number 1234, we will include this adjustment transaction as well.

Product	Line Number	Item Number	No Pallets	U.R.
Bananas	1	1	1	"W1:A:0000078:01:0001:0000"

20 Now consider some transactions that do not add stock into the warehouse, but either change the stock item characteristics or remove the stock from the warehouse completely.

Example 1:

25

An order is placed to deliver 3 cases of bananas to a customer. The transaction type used will be a delivery transaction with a type of 'D', we could equally call the

transaction order with a type of 'O' it really does not matter. The transaction number will be 99 and the warehouse is "W1".

Product	Line Number	Item Number	No Pallets/Cases	U.R.
Bananas	1	1	0/3	"W1:R:0001234:01:0001:0000"

- 5 Note that the unique reference is the original receipt unique reference that the 3 cases have been picked from. The transaction audit trail for U.R. "W1:R:0001234:01:0001:0000" will be as follows:

Trx Type	Trx No	Line No.	Item No.	Qty of	Running Qty
"R"	1234	1	1	100	100
"D"	99	1	1	3	97

- 10 Example 2:

An adjustment is now made that will actually change the batch number on one of the items. In the above example, suppose batch number "ABC777" was recorded with the original goods in transaction. We will again use an adjustment transaction to actually change the batch number from ABC777 to XYZ777. The batch number field is a principal identifier (see Concept on Principal Identifiers) and therefore requires audit control. In order to keep the auditing on the batch number correct, we would actually record a deleting transaction against batch number ABC777 and an addition transaction to Batch Number "XYZ777". The Transaction type is "A" and the number is 104, warehouse "W1".

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Product	Line No.	Item No.	No Pallets/Cases	U.R.	Batch No
Bananas	1	1	-97	"W1:R:0001234:01:0001:0000"	ABC777
	1	2	+97	"W1:R:0001234:01:0001:0000"	XYZ777

The Transaction audit trail looks like this:

Trx Type	Trx No	Line No.	Item No.	Qty of	Running Qty	Batch No
"R"	1234	1	1	100	100	ABC777
"D"	99	1	1	3	97	ABC777
"A"	104	1	1	-97	0	ABC777
"A"	104	1	2	+97	97	XYZ777

- 5 The amount of detail recorded against each transaction is unlimited. In addition to auditing and tracking details, charge and cost codes can also be linked to each transaction. These charges and costs could the point to pre-defined schedules that would allow the generation of billing and costing details on a transaction-by-transaction basis.

10

Warehouse Configuration

Objective

- 15 The warehouse is a closed system, what goes in must be auditable and traceable no matter where it is within the warehouse or what happens to it until it leaves the warehouse. The unique reference and transactions account for some of this requirement, however there is the difficulty of where to record the storage. The

warehouse configuration including the concept of regions within the warehouse allows for the recording of stock as soon as it has been made known to the warehouse.

- 5 The warehouse is broken down into regions. Each region is classified as following a "location capacity" regime or a "limitless capacity". When a region is identified as having a capacity, then it may be further broken down into unique locations. Each location will be given a capacity measured against the "base unit" chosen for the warehouse. The base unit could be anything i.e. metres, feet, pallets etc. The point is that when the product unit-set (see above) is defined with a Storage unit, then that storage unit must also have an equality to the base unit. For Example. If a location is 2.4 metres wide, and a UK Pallet is 1.2 metres, then the effective X capacity of the location is 2 U.K. pallets. Alternatively, if a Euro Pallet is defined as 0.8 metres, then the location X capacity is 3 Euro pallets or 1 U.K. pallet and 1 Euro Pallet.

- 15 3 Dimensional capacities may be defined for a location using this technique (i.e. X,Y,Z).

- 20 If the region does not have a finite capacity, then it may be subdivided into unique areas. Infinite stock may be moved into and out of these areas .

When an item is created with a unique reference, using this method, it may be given a region and location/area reference thereby immediately ensuring it's trace ability.

- 25 The invention is not limited to the embodiments described but may be varied in construction and detail.

Claims

1. A warehouse management system comprising an input interface, an output interface, a database controller and associated storage device, and a processor,
5 wherein the processor comprises means for

defining each item in an item record having a unique reference and a quantity within a warehouse closed system.
- 10 2. A system as claimed in claim 1, wherein the processor comprises means for setting item quantity to zero upon exit of an item from the warehouse closed system.
- 15 3. A system as claimed in claim 1 or 2, wherein an item is defined as a group of units stored together, and the processor comprises means for generating new item records if the units are divided.
- 20 4. A system as claimed in any preceding claim, wherein the processor comprises means for defining each item independently of location, in which present location is a current attribute.
- 25 5. A system as claimed in any preceding claim, wherein the processor comprises means for generating the unique reference from a plurality of sources of alphanumeric characters.
6. A system as claimed in claim 5, wherein the sources include a warehouse identifier, and a transaction which caused the item to exist.
- 30 7. A system as claimed in claim 5 or 6, wherein the sources include an identifier of each different category of product within the item.

8. A system as claimed in any preceding claim, wherein the processor comprises means for generating a transaction record linked to an item record for each transaction affecting and item.

5

9. A warehouse management system substantially as hereinbefore described.

Claims

1. A warehouse management system comprising an input interface, an output interface, a database controller and associated storage device, and a processor,
5 wherein the processor comprises means for

defining each item in an item record having a unique reference and a quantity within a warehouse closed system.
- 10 2. A system as claimed in claim 1, wherein the processor comprises means for setting item quantity to zero upon exit of an item from the warehouse closed system.
- 15 3. A system as claimed in claim 1 or 2, wherein an item is defined as a group of units stored together, and the processor comprises means for generating new item records if the units are divided.
- 20 4. A system as claimed in any preceding claim, wherein the processor comprises means for defining each item independently of location, in which present location is a current attribute.
- 25 5. A system as claimed in any preceding claim, wherein the processor comprises means for generating the unique reference from a plurality of sources of alphanumeric characters.
- 30 6. A system as claimed in claim 5, wherein the sources include a warehouse identifier, and a transaction which caused the item to exist.
7. A system as claimed in claim 5 or 6, wherein the sources include an identifier of each different category of product within the item.

8. A system as claimed in any preceding claim, wherein the processor comprises means for generating a transaction record linked to an item record for each transaction affecting and item.

5

9. A warehouse management system substantially as hereinbefore described.